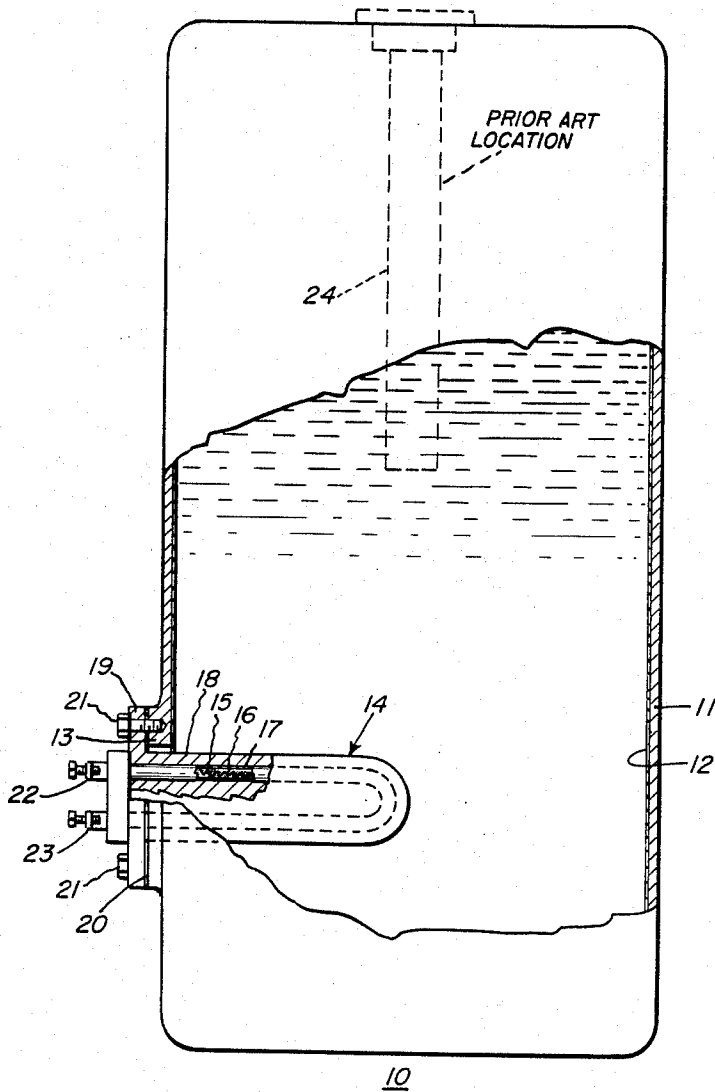


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ELECTRIC WATER HEATER
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ELECTRIC WATER HEATER

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This invention relates to an improved electric immersion type water heater unit and more particularly to a water heater unit which includes an electrical resistance element, for heating water, and a sacrificial metal anode incorporated therewith.

It is the usual practice in an electrical immersion type water heater tank assembly to provide a protective or sacrificial metal anode in the water where the electrical immersion heater is immersed, in order to protect the interior wall of the tank against excessive corrosion. In order to be able to corrode differentially and protect the metal wall of the tank, the element employed as a sacrificial metal anode must be made of a metal, which is anodic to the metal of which the wall of the tank is composed and must be connected electrically to the conducting metal wall of the tank. In those instances where the inner surface of the tank is lined with protective coatings or coverings of ceramic, glass, metal, etc., the aforementioned sacrificial metal anode is employed primarily to protect those portions of the inner surface where the coating is or may become faulty. The sacrificial metal anode through the action of galvanic currents undergoes a loss of metal and provides cathodic protection to exposed portions of the interior of the tank. It has been found that sacrificial metal anodes suffer from too rapid dissipation because of the various galvanic currents present, some of which may provide no protection for the tank, with the result that life of the tank is diminished because of the shortened life of the sacrificial metal anode. Thus, in order to take full advantage of the design life of the structure of the tank, the sacrificial metal anode must be replaced. This, however, is a difficult operation, not economically practical in many instances, and is usually indicated only by tank failure.

Accordingly, it is an object of this invention to provide an improved electrical immersion type water heater unit.

It is another object of this invention to provide a combination sacrificial metal anode and electrical immersion type water heater of improved life.

It is another object of this invention to provide an improved electrical immersion type water heater unit which incorporates a sacrificial magnesium containing metal anode therewith.

It is another object of this invention to provide an improved sacrificial magnesium anode which is adapted to be electrically grounded to the water tank and which includes an electrical immersion type water heater therein.

It is a further object of this invention to provide, in combination with protective coating lined water tank, a sacrificial magnesium anode in the form of a closed tube or sheath electrically connected to the tank, and in which there is contiguously inserted an electrical resistance heater.

Briefly described this invention relates, in one preferred form, to a unitary heating assembly for immersion in a hot water tank comprising a metal shell, which includes a sacrificial metal anode member, which is anodic to the metal of which the metal shell is composed, and an electrical resistance heater physically incorporated therewith. The unit is mounted in the hot water tank with the sacrificial metal anode electrically connected to the metal shell.

This invention will be better understood when taken

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in connection with the following description and the drawing in which:

The sole figure is an illustration of an electrical hot water assembly incorporating the heating unit of this invention.

Referring now to the drawing, there is illustrated a schematic representation of a hot water tank assembly 10. Assembly 10 include a tank consisting of a steel shell 11 which is usually lined internally with a suitable ceramic material, such as a glass liner 12. These tanks are provided with one or more boss openings 13 through which an electrical immersion type heater is inserted. The heater unit of this invention is denoted at 14 and comprises an electrical resistance element 15, embedded in electrical insulation material 16, and a cover, tube 17 usually of copper. The configuration of the heater portion of unit 14 may be that of a single or straight rod, a curved element, or the well known hair-pin type as illustrated.

In the practice of this invention a sacrificial metal anode is combined with a heater unit. The sacrificial metal anode may be in the form of a closed tube, sheath or cover which is suitably joined or attached to the heater unit. In one preferred embodiment of this invention the sacrificial metal anode covers the entire internally projecting portion of the heater unit. This cover 18 as illustrated in the drawing is incorporated with the heater unit for example by casting cover 18 about heater tube 17.

It is a requirement of this invention that the sacrificial metal anode also be electrically connected (grounded) to shell 11. This electrical connection is preferably extended to include heater tube 17 so that by the proper attachment of the sacrificial cover 18 to tube 17, and connection of cover 18 to shell 11, heater tube 17 is also electrically connected to shell 11. In the drawing, sacrificial cover 18 is shown surrounding heater tube 17 and attached to or integral with a flange member 19. electrically insulating gasket 20 is employed between flange 19 and boss 13 to provide a watertight seal. Bolts 21 are inserted through flange 19 (and engage flange 19) so that the flange 19 is securely attached to boss 13. Bolts 21 thus also provide an electrical connection between cover 18 and shell 11 for electrical grounding purposes. Electrodes 22 and 23 provide electrical connection to a suitable source of power (not shown) to energize element 15. Various additional methods and arrangements may be provided not only to position a heater unit in a tank but also to provide an electrical connection of the combined sacrificial anode to the metal shell of a tank. In many instances, however, it is more convenient to utilize the contact between flanges and/or attaching bolts for this purpose.

In contrast to the arrangement of this invention, in prior art electrical immersion type heater assemblies the sacrificial magnesium rod is often inserted into the tank at some other position, for example from the top. The usual location of such a rod is shown in the drawing by the dashed outline 24 and is further identified by the legend "Prior Art Location." With this rod functioning to corrode preferentially to protect shell 11, the heater tube 17 is generally copper and no sacrificial metal element 18 is attached thereto. In these earlier configurations under operative conditions, several separate galvanic current flows are encountered, among these being a galvanic current set up between the copper clad heater tube 17 and the sacrificial anode 24 in the top of the tank so that considerable dissipation of the sacrificial metal anode occurs. One solution to such a problem was the use of a heater assembly which was electrically insulated from shell 11. However, these conditions caused a certain amount of galvanic action between the copper tube 17 and

the wall of shell 11 so that the life of the heater element was shortened because of excessive pitting of the copper tube.

By incorporating the sacrificial metal rod as a sheath or cover 13 which is electrically grounded to shell 11, no insulation between the heater assembly 14 and shell 11 is needed. This not only eliminates need for external drain off resistances utilized between the heater unit and the tank but also inherently minimizes pitting of the copper sheathed heater unit. The cover sheath 13 as employed is used for the protection of the tank and none is wasted in other unrelated galvanic circuits. Accordingly, better distribution of protective current to the tank is provided, particularly if two heating units 14 are employed.

The sacrificial metal anode should be of a metal which readily dissolves in the usual domestic water supplies in order to provide cathodic protection through galvanic action. The metal so employed should be anodic without the use of external applied voltage. In addition, the metal should also be readily available, economical, and safe with respect to handling and use. The preferred metals for sacrificial anode purposes are those found near the top or beginning of the electromotive series. The most practical of the metals is magnesium which is the preferred anode metal of this invention. Magnesium may be employed in its single form or in various combinations with other elements or metals, for example, as an alloy with another metal. The other metals may be those both above and below magnesium in the electromotive series. Additionally, other preferred metals are zinc and aluminum, although these latter metals may require film removal means or treatment to prevent film formation on their immersed portions for continuation of galvanic action. Those metals which may be potentially unsafe to handle or use may be used in special forms such as amalgams and/or may be used in conjunction with regulation means to regulate their exposure to water.

In many locations, the available water contains a high amount of minerals, which results in a thick scale on ordinary immersion heaters. The use of magnesium, for example as a cover or sheath 13 in the present invention and the loss of that magnesium to provide protective current, will tend to keep the magnesium heat transfer surface relatively clean.

One preferred practice of this invention is to enclose an electrical immersion type heating unit within a sacrificial anode metal which is used for protection of the water tank against corrosion. The amount of sacrificial anode metal required can be reduced by using less expensive materials inside the structure to fill any interstitial spaces like those between loops of a prefabricated hair-pin heater. For example, one such inexpensive unit may be manufactured with only the sacrificial anode metal over a suitable insulation which contains the heating element. Less sacrificial metal is needed with the ceramic or glass-lined tanks than with tanks having large exposed metallic areas in contact with the water.

These heater anodes should be shaped to provide maximum utilization of anode metal over the whole length and circumference. In the usual glass-lined water tank where there is heavy consumption of a sacrificial anode near the point where the anode enters the tank, a pyramidal or conical anode with the thicker part near the tank would be desirable. For the sacrificial metal covering of the heating unit of this invention, the metals employed must be more anodic with respect to the electromotive series. These metals being preferably magnesium and its alloys.

The objects of this invention are thus achieved by utilizing preferably a magnesium coating or sheath containing an electrical immersion type water heater where the magnesium sheath is grounded to the water tank. By this means the life of the tank is greatly increased as well as

the life of the immersion heater sheath or sacrificial metal. No other sacrificial anode is necessary.

While a specific method and apparatus in accordance with this invention is described and shown, it is not intended that the invention be limited to the particular description nor to the particular configuration illustrated, and it is intended by the appended claims to cover all modifications within the spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an electrical immersion type hot water tank assembly, which is closed to enable the application of fluid pressure therein to force the water therefrom to a level above the tank, the wall of the tank comprising a metal shell with a protective coating over substantially the entire inner surface thereof and the water being heated by an electrical resistance heating element protruding through said wall into the water and adaptable to be removed from the tank without access to the interior thereof, the improvement comprising:

- (a) means completely covering the electrical resistance element and electrically insulated therefrom for cathodically protecting said metal shell of the tank, and
- (b) means for electrically connecting said protecting means to said metal shell,

(1) said protecting means being composed of metal, which is anodic to the metal of which said metal shell is composed and which when operatively connected to said metal shell continues to dissipate until substantially consumed to the degree required to cathodically protect said metal shell

2. The improvement as recited in claim 1 wherein the means for cathodically protecting the metal shell is made of an alloy of magnesium.

3. The improvement as recited in claim 1 wherein the means for cathodically protecting the metal shell consists essentially of magnesium.

4. In an electrical immersion type hot water tank assembly, which is closed to enable the application of fluid pressure therein to force the water therefrom to a level above the tank, the wall of the tank comprising a metal shell with a protective coating over substantially the entire inner surface thereof and the water being heated by an electrical resistance heating element protruding through said wall into the water and adaptable to be removed from the tank without access to the interior thereof, the improvement comprising:

- (a) a metal tube completely covering at least that portion of the electrical resistance element penetrating into the tank,

(1) said metal tube being electrically insulated from said resistance element,

- (b) means for cathodically protecting the metal shell of said tank,

(1) said protecting means being in contact with and covering the entire surface of at least a substantial portion of the length of said metal tube from adjacent the metal shell of said tank toward the distal end of said metal tube, and

- (c) means for electrically connecting said protecting means to said metal shell,

(1) said protecting means being composed of metal, which is anodic to the metal of which said metal shell is composed and which when operatively connected to said metal shell continues to dissipate until substantially consumed to the degree required to cathodically protect said metal shell.

5. The improvement as recited in claim 4 wherein the means for cathodically protecting is made of an alloy of magnesium.

6. The improvement as recited in claim 4 wherein the means for cathodically protecting consists essentially of magnesium.

7. The improvement as recited in claim 4 wherein the means for cathodically protecting has been cast over the metal tube.

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